

## Conclusions and Recommendations

### Introduction

The primary objective was to: "Prepare a document assessing the feasibility of developing a common coastal advisory for striped bass and bluefish due to PCBs. "Common" may be the whole Atlantic coast, or it may be regional (New England, Mid-Coast, Southern) depending on what the data suggests. Additionally, we recognize that while the objective is to work towards a common advisory, there may be states that participate in this process that do not sign on to any advisory we finally develop." Results from this process yielded important insight about information that states utilize from scientific disciplines as divergent as fisheries biology and management, chemistry, and toxicology. This information is necessary in order to arrive at advice that balances the need to raise public awareness for contaminant exposure while enabling constituents in each jurisdiction with the opportunity to make informed choices that serve their interests. It is a complex issue with many facets. Some of these facets include policy decisions that are beyond the scope of this report.

The findings of each workgroup provide valuable information about PCBs in striped bass and bluefish, and about how the information is applied to the process of creating fish advisories. It is clear that among Atlantic coastal states, multiple approaches with the same intent can be employed to create fish advisories. Several analytical methods are available to identify and quantify PCB tissue concentrations. Variations in biological attributes for each species, such as spawning, migration, abundance, and seasonality, play an important role in understanding how and why each jurisdiction regulates the conservation and harvest of these fish stocks. A review of the toxicological basis for assessing hazard and exposure to PCBs from striped bass and bluefish provided several approaches for consideration. The current public advice associated with exposure to PCBs through consumption has been presented for participating jurisdictions.

While it may be feasible for ~~a~~ some states to agree on common advice, it may be difficult to put into practice or may not be supported by the existing science as described in this report. Some barriers to developing common advice from a scientific perspective include migratory and breeding patterns, lack of information for both concentrations in fish and PCB toxicity endpoints and variations in techniques of doing risk assessments. From a practical perspective, some barriers include political jurisdictions (states develop advice and gather data relevant for their own locales) and variations in techniques in doing risk management. Nevertheless, the environmental longevity of PCBs combined with public desire to enjoy catching and consuming striped bass and bluefish means human exposure to PCBs is unlikely to abate anytime soon. The level of project participation across a large geographic region of the Atlantic coast reflects continued concern for the situation.

### Discussion

The effort to evaluate the feasibility of common coastal advisories was divided into four workgroups: Data, Biology, Health Effects, and Advisories. A summary of the findings and major conclusions that are relevant to the issue of developing common advice follows:

#### Data

The key objectives of the data workgroup included:

- compile and describe existing data on PCBs in striped bass and bluefish along the Atlantic coast. This was completed and reported in the data chapter.
- possibly assess feasibility of developing a centralized database accessible by all coastal states. The feasibility of this was assessed, and while it is clear it is difficult due to variations in analytical techniques and sampling protocols, it is also clear that this is an objective that should be pursued.
- possibly evaluate the feasibility of developing a common methodology for analyzing and reporting PCB data in striped bass and bluefish. This item was discussed extensively in workgroup meetings and in the data chapter. It was felt that different analytical methodologies serve different purposes and that states should preserve options to meet the needs of their sampling programs.

The primary conclusions of the data workgroup include:

There is clearly more data available on PCBs in striped bass over bluefish. Additionally, data collected vary from state to state based on the objectives within the sampling program for that state. Hence, direct comparisons of interstate data are difficult due to variability in sampling, analysis and true differences in fish populations.

The highest PCB concentrations in striped bass are associated with urban industrial locations such as the Hudson River, the NY/NJ Harbor areas and the lower Delaware River system. With less data, it is more difficult to characterize bluefish contaminations from state to state. Older data, however (NOAA 1985) suggests more consistent levels in bluefish from state to state.

## **Biology**

The key objectives of the biology workgroup included:

- summarizing information about movement and populations of striped bass and bluefish up and down the coast. That objective was completed and is discussed in the biology chapter.
- provide technical resources for other workgroups. The objective of providing technical advice was met and was invaluable to the other workgroups and to the process as a whole.

To summarize, migratory striped bass are found from Florida north to Maine, but their importance as a fishery in Florida, Georgia and South Carolina are very limited. These southern states also have populations of non-migratory riverine striped bass. The major spawning locations for striped bass include the Hudson River, the Delaware Estuary, the Chesapeake Bay, and Albermarle Sound/Roanoke River. Adult female striped bass migrate north over the summer, then overwinter off the coast of Virginia/North Carolina. Adult males and juveniles tend to stay in local waters.

Bluefish are found from Florida to Maine, but they are not important fisheries in Georgia and South Carolina. Bluefish along the Atlantic Coast are considered one population.

## **Health Effects**

The key objectives of the Health Effects workgroup include:

- summarizing information on different estimates of toxicity used by the states and federal programs in developing advisories and more generally review literature on the toxicology of PCBs. This objective was met and is described in the Health Effects Chapter.
- possibly assess and review EPA's development of a benchmark dose for PCBs. This objective was not met as the EPA's benchmark dose analysis is not available for public review.
- possibly evaluate the feasibility of developing a toxicity value based on the current literature. This objective was met and it was determined that developing a toxicity value is a goal worthy of future work.

Additional conclusions of the Health Effects group include that epidemiological studies have demonstrated behavioral deficits resulting from *in utero* exposure to PCBs. Given existing body burdens and dietary sources of PCBs in the general population, the recommendation is made that any advisory for striped bass or bluefish should not appreciably increase the body burden of PCBs in females.

### Advisories

The key objective of the Advisory Workgroup was to summarize the current advisories and fish tissue action levels for striped bass and bluefish along the Atlantic Coast. That objective was met and is discussed in the Advisory chapter.

Additionally, it was determined that while there is great variation from state to state as to how advisories for bluefish and striped bass are developed, there are also many similarities that can be used to build consensus. Perhaps more importantly, the existing recommendations (even given the various methods for derivation) have enough similarities to think about developing consistent advice on a regional basis. This is especially true of the northeast states (with relatively consistent advisories) and the southeast states (without advisories). The mid Atlantic state advisories are dominated by spawning location specific advisories and a lack of advisories on coastal waters impacting migratory fish.

### PROPOSED CONSUMPTION ADVISORIES

Possible coastal or regional advice for striped bass and bluefish need to incorporate information on the concentrations of PCBs in fish, the movement of fish, toxicology and existing advice. The development of regional or coastal advisories for striped bass

~~It may be feasible to develop consistent advisories for striped bass on a regional basis, but not along the whole Atlantic Coast. Even so, the development of regional advisories~~ are plagued by significant uncertainties. Additionally, it may be feasible to develop consistent advice for bluefish, but there are less data, and hence more uncertainty associated with this species. There are also considerations from region to region which may modify a core consistent advice. Recognizing these uncertainties and variations, the group proposes the following advice as one ~~suggestion to develop consistency~~possible core consistent advice which may be adopted or modified from state to state. Uncertainties can be limited, however, with future research, so after the proposed advice a further discussion of uncertainties and research recommendations follows.

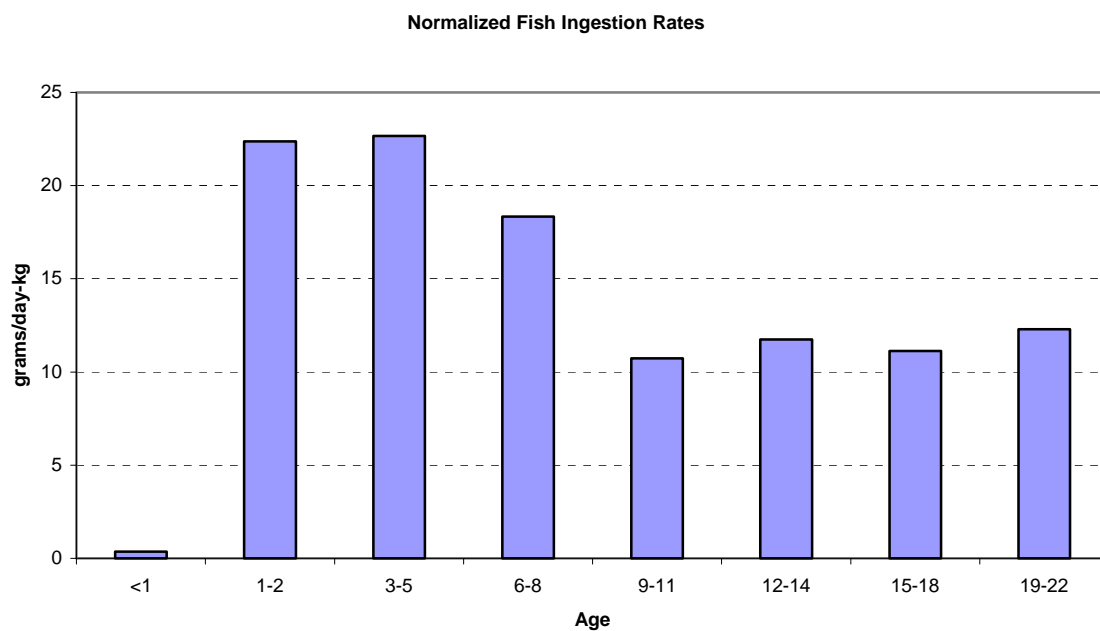
### Striped Bass

Striped bass along the east coast are distinctive in that there are both breeding locations that contain one population of striped bass (males and females) and a migratory population (predominantly mature females). Some states may have both populations and the PCB burden may vary depending on point

sources. For example, New York has both a migratory and resident population, the resident population is strongly influenced by the Hudson River with its associated PCB contamination. These breeding populations that are or are not impacted by point sources should have advice developed by the states surrounding these breeding sites, as they understand the PCB sources and fish consumption habits in these areas. The proposed advice below does not include these breeding locations.

Migratory fish (consisting of contaminated Hudson River fish as well as less contaminated fish from other locations) can also be caught off the Atlantic Coast. Migratory fish, however, will consist of a mix of mature females (at different times in different locations) from different breeding stocks (with a range of PCB levels). (as well as mature males, but they generally fall below the size limits for recreational harvest). As a mixed population (from which anglers sample over the season), they could be expected to have a different contaminant burden and can be a candidate for consistent advice. The data shows (Table 2-2) levels of PCBs in striped bass that range from 315 ppb in North Carolina to 176 ppb in Maine (with an increase in the concentration to a maximum around the New York Hudson River area).

The health effects group suggests that separate advice for a sensitive subpopulation may be derived for PCBs (as is the case with methylmercury). ~~Additionally, the chapter recommends a goal of no increase in body burden among this sensitive subpopulation.~~ The advisory chapter notes that how ~~that~~ subpopulation is defined is not consistent from state to state. Given that one concern with PCBs is developmental effects, and that PCB body burden is influenced by lifetime exposure, a reasonable definition of the sensitive subpopulation might be women of reproductive age and young girls. That subpopulation will consist of women from roughly 50 years old and younger. This advice is also reasonably consistent with the National Academy of Sciences Institute of Medicine recommendation that exposure to dioxins be minimized for this group, beginning in early childhood (IOM 2003). That said, several states have expressed concern with the exclusion of young boys from this sensitive subpopulation. There are two rationales for including young boys, ease of risk communication, and reducing cancer risk among young boys. As there are years of experience and effort in encouraging individuals to follow sport caught fish advice based on mercury contamination, there is some logic in making the sensitive population as consistent as possible with these existing recommendations for ease in risk communication. Secondly, there is a cancer risk associated with PCB ingestion, and young children, due to the ratio of ingestion rate to body size, will have increased exposure relative to an adult consuming the same product. Figure X-X plots weight normalized fish ingestion rates (from EPA 1999) at various age groups, and it shows that on a per weight basis, children between 1 and 8) consume more fish than older children and adults (roughly 9 and above).



**Figure : Children's normalized fish ingestion rates (EPA 1999).**

The toxicology chapter also recommends a goal of no increase in body burden among the sensitive subpopulation. To reach that goal, they proposed three approaches, none of which can be currently implemented (given data and effort restrictions). These three approaches include estimating PCB body burden from striped bass and bluefish, develop a relative source contribution given background PCB body burden, or compare to other PCB containing foods and their daily dose to ensure striped bass and bluefish do not dominate PCB exposure. While the last option is the simplest, even that is difficult given the limited data on total PCB concentrations in food.

The FDA's Total Diet Study (FDA 2005), does, however, identify total PCB concentrations in some foods (with very limited sample size). These data are "as consumed", meaning cooked, and the sample size represents a composite of three individual samples. The following table identifies concentrations in dietary protein sources sampled by the Total Diet Study from 1991 to 2004.

<u>Table XX</u>		
<u>Product</u>	<u>Sample Size</u>	<u>Concentration (ppb)</u>
<u>Baked Beef Chuck Roast</u>	<u>1</u>	<u>10</u>
<u>Pan cooked Beef steak loin</u>	<u>1</u>	<u>22</u>
<u>Pan cooked Pork Chop</u>	<u>1</u>	<u>21</u>
<u>Baked Pork Roast</u>	<u>1</u>	<u>18</u>
<u>Pan cooked lamb chop</u>	<u>1</u>	<u>18</u>
<u>Fried Chicken (breast, leg, thigh)</u>	<u>1</u>	<u>9</u>
<u>Canned Tuna in Oil</u>	<u>1</u>	<u>45</u>
<u>Fried Eggs</u>	<u>1</u>	<u>19</u>
<u>Homemade Meatloaf</u>	<u>1</u>	<u>23</u>
<u>Pan cooked veal cutlet</u>	<u>1</u>	<u>13</u>
<u>Roasted Chicken Breast</u>	<u>1</u>	<u>32</u>
<u>Baked Salmon Steaks or Filets</u>	<u>14</u>	<u>26</u>

Even given the uncertainties associated with differences in analytical methods, and dates of analysis, of not determining actual dose based on consumption rates and comparing prepared vs. raw foods, it is clear that no sampled protein source approaches concentrations found in recreationally caught striped bass and bluefish.

~~One division of the Atlantic coast into regions for the development of consistent advice can be supported by the biology, data and advisory chapters is: North, Mid-Atlantic, and South. Southern fish are distinctly different in that striped bass consist of a minor fishery, there is little data, and some populations are non-migratory. The northern coast is dominated by a larger recreational fishery, higher levels of PCBs and already relatively consistent advice. The mid-Atlantic is dominated by the Chesapeake Bay, both in terms of data and fish. There are not a lot of data for the large migratory females along coastal regions of the mid-Atlantic. That said, it is acknowledged that fish from the Chesapeake Bay dominate the total population of migratory Atlantic Coast striped bass, so there is some sense in extending consistent advice from New England down to Maryland. It is by dividing the Atlantic Coast into Northern State and Southern States (with the dividing line being the Virginia/Maryland border) that the proposed advice is organized.~~

### **Northern Coastal States**

~~The northern coastal states share certain characteristics that make them candidates for a consistent striped bass advisory. Striped bass PCB concentrations in offshore fish (excluding the Hudson River) ranged from a low of 172 ppb in Maine to a high of 1175 in Long Island Sound (NY). Comparing concentrations from state to state is problematic given differences in analytical technique, size of fish, and date of capture.~~

~~The northern coastal states are impacted by two populations of fish. First are the population of fish in spawning locations (not considered in this discussion) include the Hudson River, Delaware Estuary and Chesapeake Bay. Second are the migrating populations (that includes fish from the Hudson River, and all other breeding locations). Unfortunately, it is not perfectly clear in that there is some evidence that smaller and younger striped bass originating from the Hudson River will remain in estuaries in Connecticut, New York and New Jersey (see Biology Chapter).~~

Finally, the advisories for the sensitive population in these Northern states in particular, are already very close to consistent. Table 1 compares the advice for the northern coastal states sensitive population.

State	Sensitive Population	Advice
Maine		2 meals per month
New Hampshire		2 meals per month
Massachusetts	Pregnant women, women who may become pregnant, nursing mothers and children and children under 12	2 meals per week of all fish, including striped bass
Rhode Island	Pregnant women, nursing women, women planning a pregnancy and young children (under 6)	No consumption
Connecticut	Pregnant women, women planning to become	No consumption

	pregnant within a year, children under 6 and nursing women	
New York	infants, children under 15 and women of childbearing age.	<u>No consumption</u> (W. LI Sound) to 1 meal per week (E LI Sound)
New Jersey	Infants, children, pregnant women, nursing mothers and women of childbearing age	No consumption
Delaware	Women of childbearing age and children	No advice in coastal waters (has advise for Delaware Estuary)
<u>Maryland</u>	<u>Pregnant women, women who may become pregnant, nursing mothers and children and children under 6</u>	<u>No advice in coastal waters (has advice for Chesapeake Bay)</u>
<u>Virginia</u>	<u>Pregnant women, women who may become pregnant, nursing mothers and young children</u>	<u>No advice in coastal waters (has advice for Chesapeake Bay)</u>
<u>North Carolina</u>	<u>Women of childbearing age (15 to 44 years), pregnant women, nursing women, children under 15</u>	<u>No advice</u>

Of these states, Maine and New Hampshire's advisory are based on the same data. Additionally, that data has been determined to be of questionable quality. This discovery led to the initiation of this effort to determine the feasibility of consistent advice along the Atlantic Coast. Maine is also distinctive in that it is the only state that follows a "slot limit" where fish between 20 and 26 inches can be kept or fish over 40 inches. All other states have a minimum length requirement of 28 inches.

Pennsylvania was not included in this evaluation as the striped bass caught in Pennsylvania waters are those which are part of the Delaware Estuary (and as a spawning location have different levels of contamination).

Maryland does not have advice (nor data) for striped bass in coastal waters (outside the Chesapeake Bay). That said, they do have a "trophy season" in the bay from April 15<sup>th</sup> to May 15<sup>th</sup> that applies to fish over 28" long. During this time, the advice is for no more than 10 six ounce meals per year for women who are pregnant or may become pregnant or are nursing. Children under 6 can consume 10 three ounce meals per year. These trophy fish are the large migratory females that are under consideration for this effort. Fish collected from these time dates average 384 ppb total PCBs (n=50; Beaman 2006 pers. comm.)

Virginia and North Carolina have data from the James River and Albermarle Sound (respectively). They do not have data on the overwintering population of striped bass (a mix of all spawning locations) for which there is a fishery.

South Carolina, Georgia, and Florida do are not impacted by migratory striped bass – local striped bass tend to be riverine and migrate up and down stream depending on temperature gradient. These southern states also do not have a large recreational fishery for striped bass (see figures 3-1, 3-2 and 3-4). From that perspective, there may not be a need for regional consistent advice for striped bass.

Proposed consumption advice for striped bass for the sensitive population in these states could be:



*No consumption for women who may get pregnant and young women and girls.*

While this is a proposal that states may chose to adopt or not, some modifications to the proposal on a state by state basis might include listing boys with the sensitive population.

## General Population

As discussed in the advisory and health effects chapter, it is not uncommon to differentiate between the sensitive population and the general population when evaluating effects from developmental toxicants. The general population is, for these purposes considered adult women who are not going to have children, boys and men.

~~Again, the advisories for the general population in these states are already very close to consistent.~~ The following table compares the advice for the general population:

State	Advice
Maine	2 meals per month
New Hampshire	2 meals per month
Massachusetts	2 meals per week of all fish, including striped bass <del>No specific advice</del>
Rhode Island	1 meal per month
Connecticut	1 meal every 2 months
New York	1 meal per week
New Jersey	1 meal per month
Delaware	No advice for coastal waters
<u>Maryland</u>	<u>No advice for coastal waters</u>
<u>Virginia</u>	<u>No advice for coastal waters</u>
<u>North Carolina</u>	<u>No advice</u>

Again, Maine and New Hampshire's advice, as discussed previously, is based on suspect data and is expected to change. Delaware and Maryland have extensive data in their breeding locations, but not for coastal fish. Maryland's advice is specific to the Chesapeake Bay. Pennsylvania is not included striped bass in Pennsylvania waters are specific to the Delaware Estuary. Again, as South Carolina, Georgia and Florida are not impacted by migratory striped bass, they would not be candidate for consistent advice.

Proposed consumption advice for striped bass for the general population in these states could be:

*1 meal per month for men, boys, adult women who will not get pregnant.*



Gary/Tox Group to insert something on what kind of cancer risk this would represent

### **Southern Coastal States**

~~North Carolina, South Carolina, Georgia and Florida are different in that there are significantly fewer striped bass, data and advisories than in other regions. — North Carolina's data is dominated by Albermarle Sound (a spawning location). Georgia's data are based on riverine fish that do not migrate. Additionally, with the exception of North Carolina, (with its winter offshore fishery) these southern states do not have a large recreational fishery for striped bass (see figures 3-1, 3-2 and 3-4).~~

~~From that perspective, there may not be a need for regional consistent advice for striped bass.~~

### **Bluefish**

Bluefish, in some ways should be easier in that there is generally considered to be one single population along the Atlantic coast. That said, while there appears to be a large drop in PCB concentrations from Delaware south, this drop may be an artifact of the smaller fish sizes (in the range of 300 mm vs. 500-700 mm in northern states).

Current advice for the sensitive population for bluefish along the Atlantic coast is as follows.

State	Sensitive Population	Advice
Maine		2 meals per month
New Hampshire		2 meals per month
Massachusetts	Pregnant women, women how may become pregnant, nursing mothers and children under 12 years old.	No consumption
Rhode Island	Pregnant women, nursing women, women planning a pregnancy and young children (under 6 years of age)	No consumption
Connecticut	Pregnant women, women planning on becoming pregnant within a year, children under 6 and nursing women.	No consumption of fish over 25", 1 meal a month for fish between 13 and 25"
New York	Infants, children under the age of 15, women of childbearing age.	1 meal a week
New Jersey	Infants, children, pregnant women, nurrsing mothers and women of childbearing age	No consumption
Delaware	Women of childbearing age and children	No consumption
Maryland	Pregnant women, women who may become pregnant, nursing mothers and children and children under 6	No advice
Virginia	Pregnant women, nursing women, women planning a pregnancy and children	No advice
North Carolina		No advice
South Carolina		No advice

Georgia		No advice
Florida		No advice

Again, the advisories for New Hampshire and Maine are based on old questionable data and are expected to be revised based on more recent data and the outcome of this effort. Additionally, Pennsylvania is not included in that they do not have any coastal marine waters where bluefish would be found. A review of the states' advice shows a distinct division of the coast around Delaware – where Delaware and north is recommending no consumption of bluefish, while south of Delaware does not have advice (nor do they have much data, or their data is from smaller fish).

Consumption advice for the sensitive population for bluefish in Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire and Maine could be:

***No consumption for women who may get pregnant and young women and girls.***

While this is a proposal that states may chose to adopt or not, some modifications to the proposal on a state by state basis might include listing boys with the sensitive population. Additionally, there has been some interest in some states to recognize that smaller fish have lower amounts of PCBs, and hence could provide a source of some limited consumption.

It may not be possible to develop consistent advice for bluefish for Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida until the extent of PCB contamination in bluefish in these waters is adequately characterized.

### **General Population**

As discussed previously, the general population is considered adult women who are not going to have children, boys and men.

***Need to insert some information here (and the health effects chapter?) about cancer risk from PCBs.***

Unfortunately, while the concentrations for PCBs in bluefish are reasonably consistent (in the range of 300 to 900 from New Jersey to Connecticut) the advice along the coast is significantly different. Maine and New Hampshire's advisories are based on old, questionable data. Other states categorize their advisories based on size (Ct, NJ, De) or location (NY).

State	Advice
Maine	2 meals per month
New Hampshire	2 meals per month
Massachusetts	2 meals per week of all fish, including bluefish <del>No bluefish-specific advice</del>
Rhode Island	One meal per month
Connecticut	A meal every other month for fish over 25", 1 meal a month for fish between 13 and 25"
New York	1 meal a week

New Jersey	4 meals per year of bluefish > 6 lbs or 24" or 1 meal per month of bluefish <6 pounds or 24"
Pennsylvania	No advice
Delaware	Bluefish <14" 1 meal per month. >14" 1 meal per year
Maryland	No advice
Virginia	No advice
North Carolina	No advice
South Carolina	No advice
Georgia	No advice
Florida	No advice

Given the sparse and variable data, the variability in risk assessments used when going from toxicological endpoints to advice, it may not be possible to develop consistent advice for bluefish for the general population along the Atlantic Coast. Alternatively, given the relative similarities of concentration between striped bass and bluefish it may make sense to keep the bluefish advice consistent with the striped bass advice for simplicity and ease of risk communication.

Proposed consumption advice for bluefish for the general population in these states could be:

1 meal per month for men, boys, adult women who will not get pregnant.

Need to insert some information here (and the health effects chapter?) about cancer risk from PCBs.

A summary of the proposed consumption advice for recreationally caught striped bass and bluefish is presented in table X

	women who may get pregnant and young women and girls.	men, boys, adult women who will not get pregnant
Striped Bass		
Coastal Marine Waters from Maine to <del>Maryland</del> <u>North Carolina</u>	No Consumption	1 meal per month
Coastal Marine Waters from <del>Virginia</del> <u>North Carolina</u> to Florida	No Need for Consistent Advice	
Bluefish		
Coastal Marine Waters from Maine to Delaware	No Consumption	1 meal per month
Coastal Marine Waters from Maryland to Florida	Not possible to develop advice without more data	

## **Risk Communication.**

Although there was no official workgroup dealing with risk communication issues, this topic came up in the deliberations of most groups, especially the workgroup looking at consumption advisories. It is worthwhile to remember that the purpose of issuing fish consumption advisories is to change individuals behavior. One of the underlying assumptions in undertaking this entire report is that developing more consistent advisories could help in risk communication. It is well documented, that when attempting to change behavior or communicate a health message, simplicity and clarity of the message improves compliance (NCI 2002, Doak et al. 1996). In the case of migratory coastal fish, consistency of advice could simplify risk communication and improve adoption of advisories. This is particularly the case for states with shared water bodies (such as New York and Connecticut sharing Long Island Sound) but also the case for individuals traveling on vacation (and having only to remember one simple set of advice)

If it is possible to develop consistent advice by region for striped bass, or a coast wide advisory for bluefish, then a communication plan should be developed to publicize this information. This would provide a great opportunity to get our message out and hopefully reach a broader segment of the population. Any announcement by the state participating in this study could have a great impact and could generate a lot of media interest. This presents us with an opportunity to greatly expand our risk communication efforts. There should be ongoing discussions among the participating states to develop a coordinated final communication plan. Much of this will depend on if states can come to consensus about consistent advisories. However at a minimum the following communication efforts could be undertaken:

1. Develop a press release announcing the completion of the report and summarizing its conclusions.
  - Each state issues a similar version of the press release.
  - Ask EPA headquarters to participate in a press announcement nationally.
  - Work with other regional and national partners (National Marine Fisheries) on a release.
2. If the states agree to consistent advisories, then this advice should be announced in a series of coordinated press releases and fact sheets and fact sheets for the general public.
3. Post the report and associated material on a central web site and make it available to the general public and other professionals.
4. Distribute the executive summary for a broader audience.

## **Uncertainties and Research Recommendations**

Perhaps the greatest value of this document is in clearly laying out the areas where further research will fill data gaps and reduce uncertainties. Each workgroup identified recommendations for the particular chapter. A summary of these recommendations as they relate to furthering the development of coordinated advice in the future is discussed below.

## **Data Workgroup**

- Assess the feasibility of conducting a comprehensive coastwide sampling and analysis program to measure PCBs in striped bass and bluefish. This study should include archiving of fish tissue for potential future analysis (e.g., to compare future tissue concentrations of emerging contaminants to archived samples). NOAA conducted a similar PCB study in the mid-1980s for bluefish. Federal agencies, such as NOAA, EPA and FDA should be contacted to determine feasibility and funding.
- Develop a searchable common repository for striped bass and bluefish PCB data, to include data from coastal states with fisheries. Invite participation from federal agencies and academic institutions that produce PCB data for these species.
- Acknowledge that multiple methods exist for the determination and quantitation of PCBs. Encourage states to include reference materials along with PCB sample analyses, as well as a standardized approach for determining total extractable organics (TEO, “lipids”). The objective is to ensure the data generated is accurate for each chosen analytical method.
- Data on other contaminants in striped bass and bluefish should be considered and assessed (i.e., on a wet weight basis). Contaminant data (e.g., PCBs) should also be normalized to TEO content and evaluated, with due consideration of any bias due to various lipid extraction methods.

## Biology Workgroup

As any particular state will be impacted by different populations of striped bass, any PCB sampling program should be tailored to the biology of the striped bass inhabiting the waters. For example, states visited by migratory striped bass, for example, should vary their sampling times to capture different migratory stocks entering the waters. While the times of arrival are not consistent enough to allocated particular breeding populations to arrival times, it is the case that different populations will arrive at different times. An angler will be sampling randomly from these populations over the season and a sampling program should capture this.

States that are impacted by both migratory fish and that have a breeding population will need to tailor their sampling regime to capture both local fish as well as migratory fish.

Finally, southern states with resident non-migratory populations of striped bass will be measuring local sources of contamination and hence have a simpler sampling scheme.

An alternative possibility for sampling would be to sample the large migratory female striped bass that winter offshore of North Carolina. This population would represent a mix of the various stocks as would be seen migrating up and down the coast. Additional populations of overwintering striped bass include the mouth of the Hudson River and the mouth of the Chesapeake Bay. A similar strategy could be applied for bluefish, where the larger overwintering adults could be sampled off the coast of Virginia.

Depending on the location of the sampling program, it may also be worthwhile to sex the fish collected, as the female striped bass are the sex that are migrating up and down the coast while males tend to be resident.

## Health Effects Workgroup

Characterization of the relationship between exposure and effect – namely using benchmark dose analysis to identify if there is an apparent threshold and to provide a point of departure for the development of a toxicity value, such as an RfD. To derive an RfD, a pharmacokinetic model would have to be used (and developed) to convert from body burden to maternal intake.

Gather information on levels of PCBs in dietary sources and consumption patterns within the general population. This is particularly of value if the objective is to limit population exposure through the diet to this class of contaminants.

## Advisory Workgroup

Rather than focus on state to state consistency in risk assessment techniques, focus on existing similarities in advice and build on those similarities.

Develop uniformity in the definition of the sensitive population. Agreement would greatly simplify risk communication from state to state.

## Organizational Workgroup

Perhaps the largest single obstacle to understanding the contaminant concentrations in striped bass and bluefish is lack of coastwide synoptic data. This is particularly acute with bluefish. Ideally a program to analyze fish along the coast (as suggested by the data group) using consistent collection techniques and analytical methods would eliminate much of this uncertainty. A scaled down version may be possible by sampling the overwintering populations of striped bass and bluefish as described by the biology group. Sampling the overwintering population would also provide data to identify the need for advice for North Carolina's midwinter striped bass fishery. Contaminants other than PCBs should ideally also be included and fish tissue archived for future analysis.

## Conclusions

In conclusion there are several action items that can be identified and acted upon:

1). **This effort suggests it is feasible in some situations to develop consistent advisories for coastal populations of striped bass and bluefish based on PCBs.** Striped bass are distinct, however, in that there are several populations breeding in specific locations that impact their contaminant load. In other situations, the uncertainties or lack of data limits the feasibility of developing consistent advice. That said, there was surprising consistency of advice among some states given the varied methods for developing advice. Proposed advice was developed ~~for some locations and populations, which can serve as a basis for discussion among particular states and areas of further discussion or modification from state to state were specified.~~ Whether or not to proceed with the concept of developing consistent regional advice is a decision to be made by individual states. The proposed advice is:

	<u>women who may get pregnant and young women and girls.</u>	<u>men, boys, adult women who will not get pregnant</u>
<u>Striped Bass</u>		
<u>Coastal Marine Waters from</u>	<u>No Consumption</u>	<u>1 meal per month</u>

<u>Maine to North Carolina</u>		
<u>Coastal Marine Waters from North Carolina to Florida</u>	<u>No Need for Consistent Advice</u>	
<u>Bluefish</u>		
<u>Coastal Marine Waters from Maine to Delaware</u>	<u>No Consumption</u>	<u>1 meal per month</u>
<u>Coastal Marine Waters from Maryland to Florida</u>	<u>Not possible to develop advice without more data</u>	

An issue of further discussion among states is if and when they develop consistent advice would be whether or not to put young boys in the sensitive population and whether to identify less stringent advice for smaller bluefish.

	women who may get pregnant and young women and girls.	men, boys, adult women who will not get pregnant
Striped Bass		
Coastal Marine Waters from Maine to Maryland	No Consumption	1 meal per month
Coastal Marine Waters from Virginia to Florida	No Need for Consistent Advice	
Bluefish		
Coastal Marine Waters from Maine to Delaware	No Consumption	1 meal per month
Coastal Marine Waters from Maryland to Florida	Not possible to develop advice without more data	

- This effort identified a need for a coastwide evaluation of contaminants in striped bass and bluefish.** This study should involve federal agencies, should include archiving of samples and should include the development of a searchable common repository to store newly developed data as well as existing state data. A possible pilot study could include the sampling of the winter migratory fish (striped bass and possibly bluefish) found offshore of Virginia/North Carolina. These fish may accurately represent the mixed population moving along the Atlantic Coast.
- This effort identified a gap in the toxicological research and the updating of the toxicity benchmarks for regulatory use.** To sufficiently evaluate and develop advisories, a benchmark dose analysis should be performed. Additionally, it would be valuable to have background data on PCB levels in other foods.

Polychlorinated biphenyls have not been produced for commercial uses for over 30 years. While an impressive amount of research has been published on their effects on the environment and in human populations, it is clear there are areas for where further research is sorely needed. It is unfortunate that we are in the position of having to recommend any limitations to what should be a healthy food source.

## References

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